BEST AVAILABLE IMAGES

Defective images within this document are accurate representations of the original documents submitted by the applicant.

Defects in the images may include (but are not limited to):

- BLACK BORDERS
- TEXT CUT OFF AT TOP, BOTTOM OR SIDES
- FADED TEXT
- ILLEGIBLE TEXT
- SKEWED/SLANTED IMAGES
- COLORED PHOTOS
- BLACK OR VERY BLACK AND WHITE DARK PHOTOS
- GRAY SCALE DOCUMENTS

IMAGES ARE BEST AVAILABLE COPY.

As rescanning documents *will not* correct images, please do not report the images to the Image Problem Mailbox.

PCT WORLD INTELLECTUAL PROPERTY ORGANIZATION
International Bureau

INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification 7 : H01J 29/07, 29/81 — A1

(11) International Publication Number: WO 00/22644

(43) International Publication Date: 20 April 2000 (20.04.00)

(21) International Application Number: PCT/US99/23675

(22) International Filing Date: 8 October 1999 (08.10.99)

(30) Priority Data:
09/170,885 13 October 1998 (13.10.98) US

(71) Applicant: THOMSON CONSUMER ELECTRONICS, INC. [US/US]; 10330 North Meridian Street, Indianapolis, IN 46290 (US).

(72) Inventors: RAGLAND, Frank, Rowland, Jr.; 183 Delp Road, Lancaster, PA 17601 (US). MASTERTON, Walter, David; 834 Blue Grass Road, Lancaster, PA 17601 (US).

(74) Agents: TRIPOLI, Joseph, S. et al.; Thomson Multimedia Licensing Inc., P.O. Box 5312, Princeton, NJ 08540 (US).

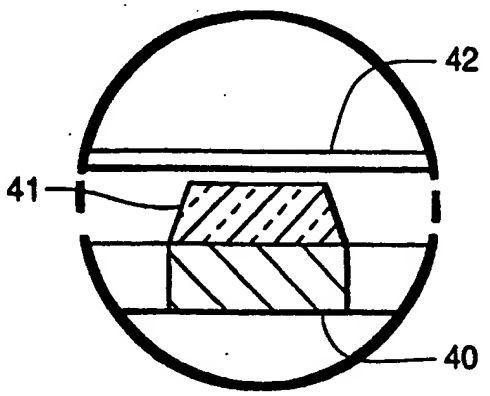
(81) Designated States: AE, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CR, CU, CZ, DE, DK, DM, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, UA, UG, UZ, VN, YU, ZA, ZW, ARIPO patent (GH, GM, KE, LS, MW, SD, SL, SZ, TZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).

Published
With international search report.

(54) Title: COLOR PICTURE TUBE HAVING A TENSION FOCUS MASK

(57) Abstract

A color picture tube (10) comprises an evacuated envelope (11) having an electron gun (26) therein for generating at least one electron beam (28), a faceplate panel (12) having a luminescent screen (22) with phosphor lines on an interior surface thereof, and a tension focus mask (24). The mask has spaced apart first metal strands (40) which are adjacent to an effective picture area of the screen and define a plurality of slots substantially parallel to the phosphor lines. Each of the first metal strands across the effective picture area has a substantially continuous insulator layer (41) on a screen-facing side thereof. The mask also includes a plurality of second metal strands (42) oriented substantially perpendicular to the first metals strands. The second metal strands are spaced from the insulator layer when the tube is not energized and are in contact with the insulator layer when the tube is energized.



FOR THE PURPOSES OF INFORMATION ONLY

Codes used to identify States party to the PCT on the front pages of pamphlets publishing international applications under the PCT.

AL	Albania	ES	Spain	LS	Lesotho	SI	Slovenia
AM	Armenia	FI	Finland	LT	Lithuania	SK	Slovakia
AT	Austria	FR	France	LU	Luxembourg	SN	Senegal
AU	Australia	GA	Gabon	LV	Latvia	SZ	Swaziland
AZ	Azerbaijan	GB	United Kingdom	MC	Monaco	TD	Chad
BA	Bosnia and Herzegovina	GE	Georgia	MD	Republic of Moldova	TG	Togo
BB	Barbados	GH	Ghana	MG	Madagascar	TJ	Tajikistan
BE	Belgium	GN	Guinea	MK	The former Yugoslav Republic of Macedonia	TM	Turkmenistan
BF	Burkina Paso	GR	Greece			TR	Turkey
BG	Bulgaria	HU	Hungary	ML	Mali	TT	Trinidad and Tobago
BJ	Benin	IE	Ireland	MN	Mongolia	UA	Ukraine
BR	Brazil	IL	Israel	MR	Mauritania	UG	Uganda
BY	Belarus	IS	Iceland	MW	Malawi	US	United States of America
CA	Canada	IT	Italy	MX	Mexico	UZ	Uzbekistan
CF	Central African Republic	JP	Japan	NE	Niger	VN	Viet Nam
CG	Congo	KE	Kenya	NL	Netherlands	YU	Yugoslavia
CH	Switzerland	KG	Kyrgyzstan	NO	Norway	ZW	Zimbabwe
CI	Côte d'Ivoire	KP	Democratic People's Republic of Korea	NZ	New Zealand		
CM	Cameroon			PL	Poland		
CN	China	KR	Republic of Korea	PT	Portugal		
CU	Cuba	KZ	Kazakstan	RO	Romania		
CZ	Czech Republic	LC	Saint Lucia	RU	Russian Federation		
DE	Germany	LI	Liechtenstein	SD	Sudan		
DK	Denmark	LK	Sri Lanka	SE	Sweden		
EE	Estonia	LR	Liberia	SG	Singapore		

COLOR PICTURE TUBE HAVING A TENSION FOCUS MASK

This invention relates to color picture tubes having tension masks, and particularly to a color picture tube having a tension focus mask.

Background Of The Invention

A color picture tube includes an electron gun for generating and directing three electron beams to a screen of the tube. The screen is located on the inner surface of a faceplate of the tube and comprises an array of elements of three different color emitting phosphors. A color selection electrode, which may be either a shadow mask or a focus mask, is interposed between the gun and the screen, to permit each electron beam to strike only the phosphor elements associated with that beam. A shadow mask is a thin sheet of metal, such as steel, that is contoured to somewhat parallel the inner surface of the tube faceplate. A focus mask comprises dual sets of conductive lines that are perpendicular to each other and usually separated by an insulative layer.

U.S. Patent 5,646,478, issued to R. W. Nosker et al. on July 8, 1997, and U.S. Patent 5,647,653, issued to S. C. Cherukuri on July 15, 1997, disclose focus mask tubes wherein the masks are formed by two perpendicular sets of metal strands. One set of strands is under tension and includes an insulator coating that is applied in two layers of different materials. The second or top layer is used to attach the second set of strands to the first set, by sintering. U.S. Patent 5,629,051, issued to E. S. Poliniak on May 13, 1997, discloses a method of applying the insulator coating to the first set of strands.

A few problems exist with the technique of attaching the two sets of strands. For example, the second insulator layer can chip, thereby leaving particles within a tube. When subjected to shock, the strands may shift relative to each other, and, because of their mutual attachment, the strands may be unable to return to their original positions. The present invention provides a mask structure that eliminates such problems.

Summary Of The Invention

The present invention provides a color picture tube comprising an evacuated envelope having an electron gun therein for generating at least one electron beam, a faceplate panel having a luminescent screen with phosphor lines on an interior surface thereof, and a tension focus mask. The mask has spaced apart first metal strands which are adjacent to an effective picture area of the screen and define a plurality of slots substantially parallel to the phosphor lines. Each of the first metal strands across the effective picture area has a substantially continuous insulator layer on a screen-facing side thereof. The mask also includes a plurality of second metal strands oriented substantially perpendicular to the first metal strands. The second metal strands are spaced from the insulator layer when the tube is not energized and are in contact with the insulator layer when the tube is energized.

Brief Description Of The Drawings

In the drawings:

FIGURE 1 is a side view, partly in axial section, of a color picture tube embodying the invention.

FIGURE 2 is a perspective view of a tensioned shadow mask-frame assembly in the tube of FIGURE 1.

FIGURE 3 is an isolated view of a vertical strand in cross-section, and a horizontal strand taken at circle 3 in FIGURE 2.

FIGURE 4 is the same view as FIGURE 3 during activation of the tube.

Detailed Description Of The Preferred Embodiments

FIGURE 1 shows a color picture tube 10 having a glass envelope 11 comprising a rectangular faceplate panel 12 and a tubular neck 14 connected by a rectangular funnel 15. The funnel 15 has a main internal conductive coating (not shown) that extends from a first anode button 16 to the neck 14. A second anode button 17, located opposite the first anode button, is in contact with a secondary internal conductive coating (not shown) on the funnel 15. The panel 12 comprises a substantially flat viewing faceplate 18 and a peripheral flange or sidewall 20, which is sealed to the funnel 15 by a glass frit 21. A three-color phosphor screen 22 is carried by the inner surface of the faceplate 18. The screen 22 is a line screen with the phosphor lines arranged in triads, each triad including a phosphor line of each of three colors. The phosphor lines approximately parallel a minor axis Y of the tube. A tension focus mask 24 is removably mounted in predetermined spaced relation to the screen 22. An electron gun 26, shown schematically by dashed lines in FIGURE 1, is centrally mounted within the neck 14 to generate and direct three inline electron beams 28, a center beam and two side or outer beams, along convergent paths through the mask 24 to the screen 22.

The tube 10 is designed to be used with an external magnetic deflection yoke, such as the yoke 30 shown in the neighborhood of the funnel-to-neck junction. When activated, the yoke 30 subjects the three beams to magnetic fields which cause the beams to scan horizontally and vertically in a rectangular raster over the screen 22.

The tension focus mask 24, shown in FIGURE 2, is made, preferably, from a thin rectangular sheet of about 0.05 mm (2 mil) thick low carbon steel. The sheet is etched into a plurality of elongated first metal strands 40, each having a transverse dimension, or width, of about 0.3 mm (12 mils) separated by substantially equally spaced slots, each having a width of about 0.55 mm (21.5 mils), that approximately parallel the minor axis Y of the tube. In a color tube having a diagonal dimension of 68 cm (27V), there are about 600 of the first metal

strands 40. One surface of each strand 40 is coated with an insulator layer 41. Preferably, the layer 41 is continuous along the length of each strand 40.

A plurality of second metal strands 42, each having a diameter of about 0.025 mm (1 mil), are disposed substantially perpendicular to the first metal strands 40. The preferred material for the second metal strands is Invar (TM Reg. #63,970) wire. The vertical spacing, or vertical pitch, between adjacent second strands 42 is about 0.41 mm (16 mils). The relatively thin second metal strands 42 cooperate with the first metal strands 40, to provide focusing of the electron beams 28. The focus mask, as described herein, provides a mask transmission, at the center of the screen, of about 60%. For a conventional shadow mask, the transmission is of 18% to 20%. When the tube is energized, the voltage applied to the first metal strands 40 differs from the voltage applied to the second metal strands 42 by less than 1 kV, at an anode voltage of about 30 kV. The voltages are applied to the two anode buttons 16 and 17 and are conducted to the strands 40 and 42, respectively, by the main and secondary internal coatings on the funnel 15.

A frame 44, for supporting the tensioned focus mask 24, is shown in FIGURE 2. The frame 44 includes a large rectangular section 46 that has two long sides 48 and 50, substantially paralleling the major axis X of the tube, and two short sides 52 and 54, paralleling the minor axis Y of the tube. The long sides 48 and 50 have more than twice the height, in the longitudinal axis Z direction, of the height of the short sides 52 and 54. The plurality of first metal strands 40 extend between the long sides 48 and 50 of the frame section 46. Connected to the shorts sides 52 and 54, by springs 56, are two second strand support sections 58 and 60, respectively. The two sections 58 and 60 are separated from and parallel to the short sides 52 and 54. The plurality of second metal strands 42 are connected to and extend between the two sections 58 and 60, with the springs 56 applying a slight tension on the strands 42. The second metal strands 42 must be electrically isolated from the first metal strands 40. There are several ways to accomplish this isolation, such as by forming the springs 56 or the sections 58 and 60 from non-conductive materials, or by forming these components from laminated materials, with one of the laminated materials being non-conductive.

Unlike the tension focus masks of the prior patents cited above, the second metal strands 42 are not permanently attached to the first metal strands 40 by an insulator layer; instead they are separated and spaced from the insulator layers 41 on the first metal strands 40, as shown in FIGURE 3. However, as shown in FIGURE 4, when the tube 10 is energized, e.g., with a difference of a few hundred volts between the first and second metal strands, 40 and 42, an electrostatic attraction occurs between the two sets of strands that brings the second metal strand 42 into contact with the insulator layers 41 on the first metal strands 40.

Preferably, the insulator layers 41 have a thickness in the range of 0.05 to 0.09 mm (2 to 3.6 mils) across the strands 40. The preferred material for the insulator layers 41 is a lead-zinc-borosilicate devitrified solder glass that melts in the range of 400° to 450° C and is commercially available, as SCC-11, from a number of glass suppliers, including SEM-COM, Toledo, Ohio, and Corning Glass, Corning, New York. The set of metal strands 42 preferably are spaced about 0.025 to 0.05 mm (1 to 2 mils) from the insulative layers 41 on the strands 40, when the tube 10 is inactive.

An advantage of the above-described mask construction is that the strands are free to return to their nominal positions, when their electrical potentials are removed. Therefore, the positions of the strands are unaffected by mechanical shocks that could otherwise shift them if they were permanently attached together.

CLAIMS

1. A color picture tube (10) comprising an evacuated envelope (11) having an electron gun (26) therein for generating at least one electron beam (28), a faceplate panel (12) having a luminescent screen (22) with phosphor lines on an interior surface thereof, and a tension focus mask (24) having spaced apart first metal strands (40) which are adjacent to an effective picture area of said screen and define a plurality of slots substantially parallel to said phosphor lines, each of said first metal strands across said effective picture area having a substantially continuous insulator layer (41) on a screen-facing side thereof, and a plurality of second metal strands (42) oriented substantially perpendicular to said first metal strands, said second metal strands being spaced from said insulator layers when said tube is not energized and being in contact with said insulator layer when said tube is energized.

2. A color picture tube (10) comprising an evacuated envelope (11) having an electron gun (26) therein for generating at least one electron beam (28), a faceplate panel (12) having a luminescent screen (22) with phosphor lines on an interior surface thereof, and a tension focus mask (24) having spaced apart first metal strands (40) which are adjacent to an effective picture area of said screen and define a plurality of slots substantially parallel to said phosphor lines, each of said first metal strands across said effective picture area having a substantially continuous insulator layer (41) on a screen-facing side thereof, and a plurality of second metal strands (42) oriented substantially perpendicular to said first metal strands, said second metal strands being spaced from said insulator layers a distance that allows contact of said second metal strands with said insulator layers through electrostatic attraction when said tube is energized.

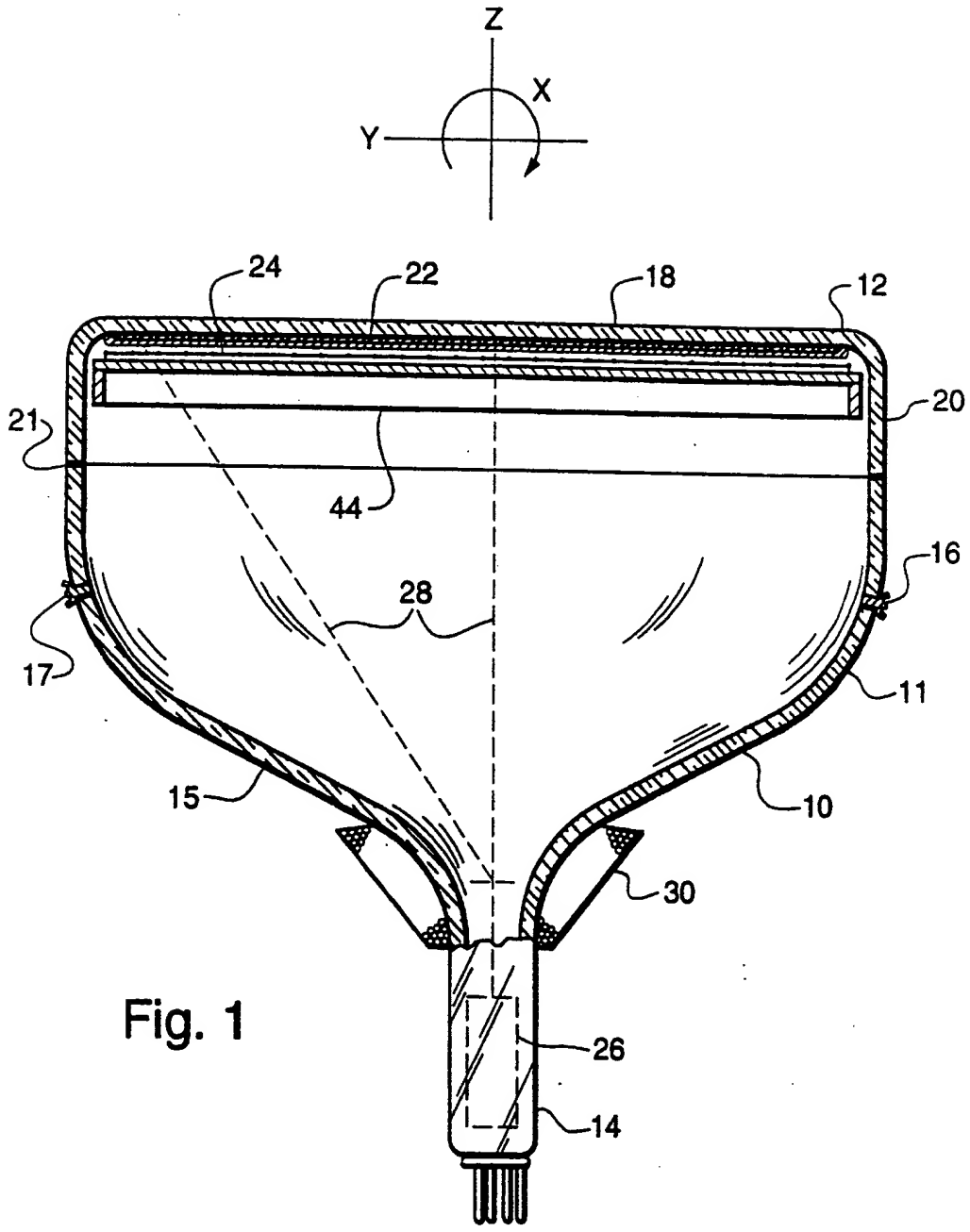


Fig. 1

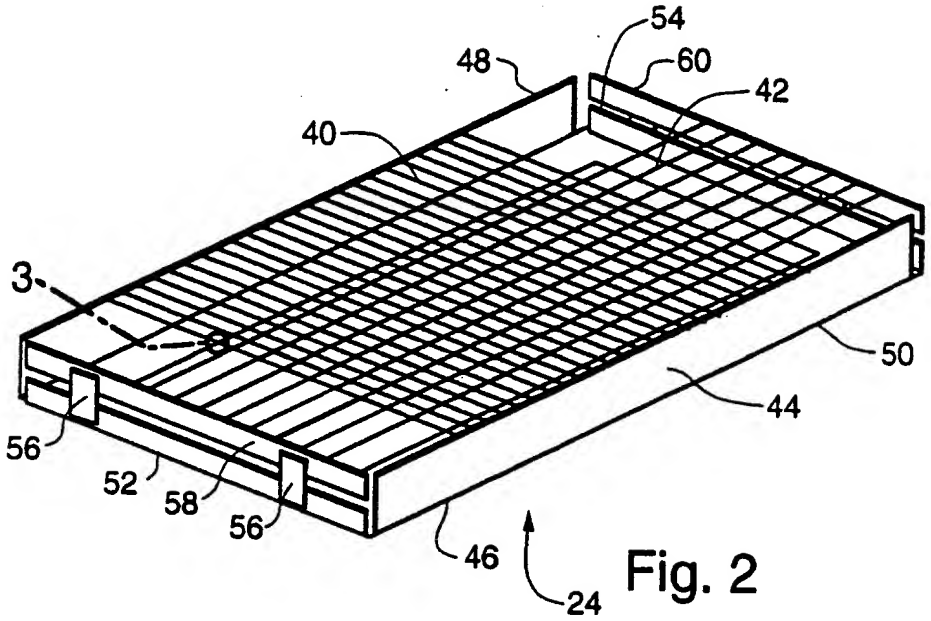


Fig. 2

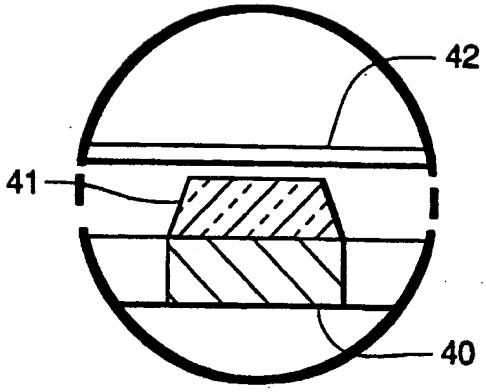


Fig. 3

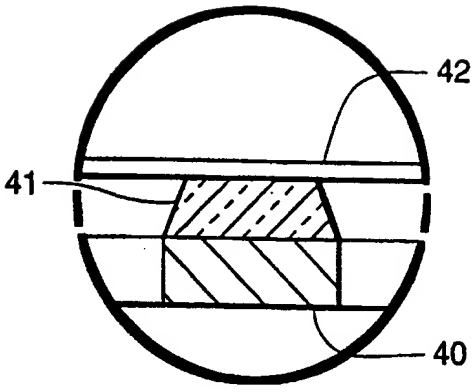


Fig. 4

INTERNATIONAL SEARCH REPORT

Inter. ...nal Application No
PCT/US 99/23675

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 H01J29/07 H01J29/81

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 H01J

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO 97 05643 A (THOMSOM MULTIMEDIA S A ;NOSKER RICHARD WILLIAM (US); MICHALCHUK JO) 13 February 1997 (1997-02-13) claims 1-4	1
A	& US 5 646 478 A cited in the application	

☐ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
18 January 2000	25/01/2000

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL – 2280 HV Rijswijk Tel. (+31–70) 340–2040, Tx. 31 651 epo nl, Fax: (+31–70) 340–3016	Van den Bulcke, E

1

INTERNATIONAL SEARCH REPORT

Information on patent family members

Inter nal Application No
PCT/US 99/23675

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 9705643 A	13-02-1997	US 5646478 A	08-07-1997
		AU 6676296 A	26-02-1997
		CA 2226504 A	13-02-1997
		CN 1191626 A	26-08-1998
		EP 0840938 A	13-05-1998
		JP 11510305 T	07-09-1999